

HOT-289: Chief Scientist Report

Chief Scientist: R. Walter Deppe

R/V Kilo Moana

January 22-26, 2017

Cruise ID: **KM 17-02**

Departed: January 22, 2017 at 1020 (HST)

Returned: January 26, 2017 at 0730 (HST)

Vessel: **R/V Kilo Moana**

Master of the Vessel: Captain Gray Drewry

OTG Marine Technicians: Jeff Koch, Sonia Brugger, and Patrick A'Hearn

1. SCIENTIFIC OBJECTIVES

The objective of the cruise was to maintain a collection of hydrographic and biogeochemical data at the Hawaii Ocean Time-series (HOT) stations. Four stations were to be occupied during the cruise, in the following order:

- 1) Station 1, referred to as Station Kahe, is located at 21° 20.6'N, 158° 16.4'W and was to be occupied on January 22nd for about 2 hours.
- 2) Station 2, referred to as Station ALOHA, is defined as a circle with a 6 nautical mile radius centered at 22° 45'N, 158°W. This is the main HOT station and was to be occupied January 22-25th.
- 3) Station 50, the site of WHOTS-13 Mooring (anchor position 22° 47.24' N, 157° 54.45' W) was to be occupied for about one hour on January 25th.
- 4) Station 6, referred to as Station Kaena, is located off Kaena Point at 21° 50.8'N, 158° 21.8'W and was to be occupied on January 25th for about 2 hours.

Upon arrival to Station Kahe a ~1300 lb. weight-test cast to 1000 m, one CTD cast to 1000 m, and a Hyperpro cast were to be conducted the afternoon of January 22th. The single CTD cast was to be conducted to collect continuous profiles of various physical and chemical parameters. Water samples were to be collected at discrete depths for biogeochemical measurements. After these operations were satisfactorily completed, the ship was to proceed to Station ALOHA. At the edge of ALOHA circle, a sea glider was to be deployed (weather permitting) before continuing on to the center of Station ALOHA.

Upon arrival to Station ALOHA, the free-drifting sediment trap array was to be deployed. The sediment trap array was to stay in the water for about 53 hours. This was to be followed by a 1000 m CTD cast for preparation of the Primary Productivity Array. This cast was to be followed by the deployment of the free-drifting Net Trap to collect sinking particles for 24hrs and the free-drifting Primary Productivity Array to incubate in-situ for 12 hours. A full-depth (~4740 m) CTD cast was to be conducted after the deployment of the Primary Production Array, followed by 1000 m CTD casts at strict 3 hour intervals for at least 36 hours for continuous and discrete data collection, ending with another full-depth CTD cast at 2300 on January 24th.

Another free-drifting array (Gas Array) was to be deployed for 24 hours for incubation experiments on January 24th. The Gas Array was to be recovered on January 25th.

A plankton net was to be towed between 1000-1400, and 2200-0200 for 30 minute intervals on January 23rd and 24th at Station ALOHA.

The Hyperpro (a profiling unit with one up-looking and one down-looking hyperspectral radiometer, a WET Labs ECO-BB2F triplet, temperature and conductivity sensors), was to be deployed on January 22nd, 23rd and 25th.

A trace metal free sample was to be collected by the ATE sampler on January 24th at Station ALOHA.

An optical package consisting of a SeaBird Seacat with temperature, conductivity, fluorometer, and pressure sensors, and a LISST particle size and distribution analyzer was to be used to profile the upper 200 m at Station ALOHA in the early morning on January 25th.

A hydrophone was to be deployed over the side to about 10-20 m water depth for about 1 hour, on 4 occasions.

After the 36 hour burst period of CTD work at Station ALOHA was accomplished, the ship was to transit to recover the floating Gas Array and the Sediment Trap Array on the morning of November 25th.

After recovering the arrays, the ship was to transit to Station 50 to conduct a one-hour 200 m CTD yo-yo cast. Once operations at Station 50 were complete, the ship was to transit to Station ALOHA to conduct a Hyperpro cast.

Once operations at Station ALOHA were complete, the ship was to transit to Station 6, referred to as Station Kaena where a near-bottom CTD cast (~2500 m) was to be conducted to collect salinity and chlorophyll samples for calibration. After Station Kaena operations were complete, the ship was to transit back to Pier 35.

The following instruments were to collect data throughout the cruise: shipboard ADCP, thermosalinograph, the underway fluorometer, underway flow cytometer, and the meteorological package. An ultra-filtration system was to be connected to an outlet of the underway seawater system to sample continuously throughout the cruise.

One of the ship's acoustic transducers was to be run through a power amplifier to collect data on the approach and departure from the ALOHA Cabled Observatory (ACO, 22 44'N, 158W) whenever possible when the ship was within 30km of ACO.

2. SCIENCE PERSONNEL

Participant	Title	Affiliation
Susan Curless	Research Associate	UH
Alexa Nelson	Research Associate	UH
Dan Sadler	Research Associate	UH
Brenner Wai	Research Associate	UH
Timothy Burrell	Research Associate	UH
Blake Watkins	Marine Engineer	UH
Tara Clemente	Research Associate	UH/SCOPE
Eric Shimabukuro	Research Associate	UH/SCOPE
Ryan Tabata	Research Associate	UH/SCOPE
Fernando Santiago-Mandujano	Research Associate	UH
R. Walter Deppe	Research Associate	UH
Jefrey Snyder	Marine Technician	UH
Andrew King	Research Associate	UH
Svetlana Naratov	Graduate Student	UH

Gerianne Terlouw	Post Graduate Trainee	UH
Eint Kyi	Graduate Student	UH
Connor Love	Graduate Student	UCSB
Vincent Varamo	Graduate Student	UH/ORE
Fadli Syamsudin	Visiting Scholar	UH/ORE
Xiaofeng Zhao	Visiting Scholar	UH/ORE
Grant Blackinton	Consultant	UH/ORE
Amanda Wong	Undergraduate Volunteer	UH
Amie Dobracki	Graduate Student Volunteer	UH
Jeff Koch	Marine Technician	OTG
Sonia Brugger	Marine Technician	OTG
Patrick A'Hearn	Marine Technician	OTG/UW

3. GENERAL SUMMARY

The cruise departed from Pier 35 a little over an hour later than scheduled because one of the crew members had a flight delay that prevented him from getting to Honolulu on time. A replacement crew member was called in and the ship departed upon his arrival.

Operations during the cruise were modified from plans due to rough seas and strong winds at Station ALOHA that eased during the cruise. Winds from the E at 25-30 kts and 12-15 ft seas were present during transit to Station ALOHA after passing Kaena Point. Upon arriving at Station ALOHA on the morning of January 23rd, winds were still steady at 25-30 kts (with higher gusts) and the wind swell was 10-12 ft. Deployments of the sea glider, sediment traps, the primary productivity array, and the net trap were cancelled until further notice upon observing conditions on station.

The wind and sea conditions were continually assessed throughout the morning and by first-light the wind had eased to 18-23 kts and the sea state had settled down to 8-10 ft. At this point, after discussing with the Captain, it was determined that the conditions had eased to the point where it was considered safe to deploy the CTD for a deep cast. This led to a 2-hour delay in the deep cast and the first cast of the 36-hour CTD burst period was deployed 2-hours later than planned. Despite this delay, the number casts planned to be conducted during the period were all completed successfully.

By the afternoon of January 23rd, conditions had eased to about 15-20 kts with 5-7 ft seas. By January 24th, winds at Station ALOHA were from the ENE at about 15-22 kts and seas had decreased to about 4-6 ft. Overnight, a long-period NW swell of 10-12 ft developed and remained through January 25th and winds and sea-state remained steady.

One 1000 m CTD cast was completed at Station Kahe. Two near bottom CTD casts and twelve 1000 m CTD casts were conducted at Station ALOHA. One 200 m yo-yo CTD cast was completed near the WHOTS mooring (Station 50) with five cycles completed. One near bottom CTD cast was completed at Station Kaena.

The sediment trap array was deployed and recovered successfully. Due to weather delays, the sediment trap array was only in the water for about 43 hours.

The Primary Productivity array and its associated cast were moved to January 24th, taking the place of the Gas Array. The Hyperpro cast scheduled for January 24th was also moved to January 25th to coincide with the Primary Productivity array.

Five net tows for the core HOT zooplankton collection were completed successfully; two during the day, and three during the night. The net tow scheduled for January 23rd was cancelled due to the strong winds and high sea state.

The ATE deployment scheduled for January 24th was cancelled because the device would not communicate.

The Hyperpro casts (three cycles each) were successfully conducted three times around the re-scheduled 1330-1430 time slots on January 22nd, 24th, and 25th.

The newly re-designed optical package was deployed one time during the cruise in the early morning on January 25th for three cycles.

The sea glider was successfully deployed at Station ALOHA on the afternoon of January 25th following a rescheduling due to rough seas and strong winds earlier in the cruise. A series of test dives were performed before the ship left Station ALOHA.

The first hydrophone cast on January 23rd was conducted successfully but a connector was damaged and there was no replacement available. All subsequent hydrophone casts were cancelled for this reason.

The fluorometer and flow cytometer functioned well during the cruise, however **connections of these two systems with the GPS experienced frequent interruptions during the cruise.** The ultrafiltration system functioned well throughout the cruise, with a temporary interruption due to a faulty connection with the console due to seawater damage. The ship's ADCP, thermosalinograph, and the meteorological suite functioned well, however due to software modifications before the cruise, some of the links to access the data were not available until they were fixed by the OTG the second day of the cruise. The bottom depth and pinger trace from the Knudsen system were only available in the Computer lab, but not in the CTD Lab. The tension display for the 0.681 winch (used for CTD casts) was available, but the graphic scale could not be adjusted.

The acoustic transducer system worked well throughout the cruise for the ACO acoustic work.

We arrived at Pier 35 for off-loading on January 26th, at 0730 (HST).

The following operations were cancelled due to the rough seas and winds experienced during the cruise in order to preserve the safety of the personnel and equipment:

1. The Gas Array deployment was cancelled.
2. The CTD cast associated with the Gas Array was cancelled
3. The Net Trap deployment was cancelled.

The following operations were cancelled due problems with equipment:

1. The ATE would not communicate so the cast was cancelled.
2. Three out of four hydrophone casts were cancelled due to problems with a connector following the first hydrophone cast.

4. R/V *Kilo Moana* OFFICERS AND CREW, TECHNICAL SUPPORT

The R/V *Kilo Moana* provided good ship support for our work. Captain Gray Drewry and the entire ship's crew showed enthusiasm, concern, and dedication to our scientific mission. The input and safety concerns of the Captain and crew were very valuable in the decision-making process for determining when conditions were too rough to conduct operations safely.

Technical support during this cruise was also good. The OTG personnel were available at any time to assist in our work during the cruise. Having a third OTG technician on board was helpful. **Before the next cruise on the R/V *Kilo Moana*, it is requested that the problems with the GPS feed for the underway fluorometer and flow cytometer be fixed.**

5. DAILY REPORT OF ACTIVITIES (HST)

January 22, 2017

0930- Captain's briefing and science briefing
1020- Depart Pier 35
1230- Fire and safety drills
1305- Arrive Station Kahe
1320- Hyperpro
1428- Weight cast to 1000 m
1458- Recover weight
1533- S1C1 1000 m cast
1654- End of cast
1730- Transit to lee of Oahu to crane SeaMac winch one bolt pattern aft
1815- Transit to ALOHA (winch-move complete)

January 23, 2017

0150- Arrive Station ALOHA
0210- Decision made not to deploy arrays yet (30 kt winds and 12-15 ft seas)
0430- Re-assessed winds and sea state, decision to wait for first-light for deep cast
0713- S2C1 Near bottom CTD
0923- 11m off the bottom @ 22° 45.021'N, 158° 0.010'W
1136- End of cast
1200- Hydrophone deployment
1313- S2C2 1000 m CTD
1431- End of cast
1452- Start Sediment Trap Deployment
1525- Sediment Trap Deployed @ 22° 45.029'N, 158° 0.004'W
1556- S2C3 1000 m CTD
1715- End of cast, transit to pump ship's tanks
1842- S2C4 1000 m CTD
2005- End of cast
2118- S2C5 1000 m CTD
2235- End of cast
2240- Net Tow
2318- End of Tow
2325- Net Tow
2348- End of Tow
2355- S2C6 1000 m CTD

January 24, 2017

0106- End of cast
0158- S2C7 1000 m CTD
0311- End of cast
0430- Start Primary Productivity Array Deployment
0505- Primary Productivity Array Deployed @ 22° 44.760'N, 157° 59.754'W
0524- S2C8 1000 m CTD
HOT-289 Chief Scientist Report

0646- End of cast
0650- Transit to pump ship's tanks
0801- S2C9 1000 m CTD
0913- End of cast
0955- Net Tow
1024- End of Tow
1030- ATE cancelled (not communicating)
1054- S2C10 1000 m CTD
1157- End of cast
1211- Net Tow
1240- End of Tow
1320- Hyperpro cast
1400- End Hyperpro cast
1407- S2C11 1000 m CTD
1516- End of cast
1520- Transit to pump ship's tanks
1708- S2C12 1000 m CTD
1819- End of cast
1820- Transit to Primary Productivity array
1914- Primary Productivity Array recovery @ 22° 41.74'N, 158° 7.11'W
1930- Transit to Station ALOHA
2000- S2C13 1000 m CTD
2111- End of cast
2158- Net Tow
2224- End of Tow
2318- S2C14 CTD to near bottom

January 25, 2017

0109- CTD 11 m off bottom @ 22° 45.02'N, 158° 0.01'W
0245- End of cast
0314- Deploy optics package
0451- Optics recovered
0500- Transit to pump ship's tanks
0540- Transit to WHOTS mooring
0622 - Start S50C1 CTD yo-yo cast (5 cycles to 200 m)
0741- End of cast
0815- Transit to Sediment Traps
1017- Sediment Traps recovery @ 22° 36.73'N, 158° 16.54'W
1040- Transit to Station ALOHA
1155- Arrive at Station ALOHA
1247- Sea Glider deployed @ 22° 41.10'N, 158° 2.02'W
1304- Sea Glider began test dives
1330- Hyperpro cast
1510- Transit to center of Station ALOHA to pass by ACO for acoustic team test
1525- Transit to Station Kaena
2050- Arrive Kaena Station
2102- S6C1 CTD to near-bottom
2224- CTD 18 m off bottom @ 21° 50.845'N, 158° 21.679'W
2307- End of cast
2315- Transit to Pier 35

January 26, 2017

0730- Arrive at Pier 35

HOT program sub-components:

Investigator	Project	Institution
Matt Church Dave Karl Bob Bidigare	Core Biogeochemistry	UH
John Dore	Biogeochemistry QA/QC	MSU
Roger Lukas	Hydrography	UH
Mike Landry	Zooplankton dynamics	SIO
Ricardo Letelier	Optical measurements	OSU
Ancillary programs:		
Andrew Dickson	CO ₂ dynamics and inter-calibration	SIO
Paul Quay	DI ¹³ C	SIO
Matt Church	SCOPE: Diversity and activities of nitrogen-fixing microorganisms	UH
Sara Ferron-Smith	Determination of net community production from the diurnal variability of oxygen and argon ratios Seasonal variability in productivity and respiration in the North Pacific Subtropical Gyre	UH
Sam Wilson	SCOPE: Reduced gases in the upper ocean: The cycling of methane, sulfide and nitrous oxide Samples to verify a long-term trend CH ₄	UH
Virginia Armbrust	SCOPE: Seaflow Underway Flow Cytometer	UW
Dave Caron	SCOPE: DNA collection	USC
Ed DeLong	SCOPE: DNA and Viral DNA collection	UH
Dan Repeta	SCOPE: DOM collection	WHOI
Angelique White	SCOPE: Diazatroph Microscopy	OSU
Dave Karl	SCOPE: Sea Glider Deployment	UH
Oscar Sosa	High molecular weight dissolved organic matter sampling	UH
Bruce Howe	Acoustics at Station ALOHA: RAP Tomography	UH

Connor Love	Relation of cyanobacteria to marine hydrocarbon geochemistry	UCSB
Sam Wilson	Deep water profile for methane and nitrous oxide	UH
Rhea Foreman	Method development for the direct determination of dissolved organic nitrogen	UH
Kim Lema	Collection of bacterial biofilms from waters distant to land	UH

Ancillary experiments and sample collections not conducted due to rough conditions:

Eint Kyi	SCOPE: Net Trap Experiments: to study the remineralization of sinking particles by various bacteria	UH
----------	---	----